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A Monte-Carlo Analysis of Organic Volatility with Aerosol Microphysics

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A newly developed box model, MATRIX-VBS, includes the volatility-basis set (VBS) framework in an aerosol microphysical scheme MATRIX (Multiconfiguration Aerosol TRacker of mIXing state), which resolves aerosol mass and number concentrations and aerosol mixing state. The new scheme advanced the representation of organic aerosols in models by improving the traditional and simplistic treatment of organic aerosols as non-volatile and with a fixed size distribution. Further development includes adding the condensation of organics on coarse mode aerosols – dust and sea salt, thus making all organics in the system semi-volatile. To test and simplify the model, a Monte-Carlo analysis is performed to pin point which processes affect organics the most under varied chemical and meteorological conditions. Since the model's parameterizations have the ability to capture a very wide range of conditions, all possible scenarios on Earth across the whole parameter space, including temperature, humidity, location, emissions and oxidant levels, are examined. The Monte-Carlo simulations provide quantitative information on the sensitivity of the newly developed model and help us understand how organics are affecting the size distribution, mixing state and volatility distribution at varying levels of meteorological conditions and pollution levels. In addition, these simulations give information on which parameters play a critical role in the aerosol distribution and evolution in the atmosphere and which do not, that will facilitate the simplification of the box model, an important step in its implementation in the global model GISS ModelE as a module.